

**Amendment and Response**

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Applicant(s): Derderian et al.

Serial No.: 10/042,025

Confirmation No.: 5745

Filed: October 25, 2001

For: METHODS FOR FORMING ROUGH RUTHENIUM-CONTAINING LAYERS AND  
STRUCTURES/METHODS USING SAME**Remarks**

The Office Action mailed November 15, 2002 has been received and reviewed. Claim 37 was amended. Claims 30-40 are pending.

Claim 37 was amended to more clearly recite the claimed subject matter, and not in response to any document cited in the office action. Support for the amendment to claim 37 can be found through out the specification, including, but not limited to, page 6, lines 15-21.

Reconsideration and withdrawal of the rejections are respectfully requested in view of the following remarks.

**The 35 U.S.C. §103 Rejection**

The Examiner rejected claims 30-40 under 35 U.S.C. §103 as being unpatentable over Nakabayashi (U.S. Patent No. 6,337,238 B1).

Applicants traverse this rejection and submit that claims 30-40 are not *prima facie* obvious for at least the following reasons. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claim limitations. See M.P.E.P. § 2143.

**Claims 30 and 36**

Claims 30 and 36 are not *prima facie* obvious in view of Nakabayashi for several reasons. First, Nakabayashi fails to teach or suggest all the elements recited in claims 30 and 36. For example, Nakabayashi fails to teach or suggest a conductive structure that comprises a rough ruthenium layer or ruthenium oxide layer having a surface area greater than about 1.2 times a surface area of a completely smooth surface having substantially the same shape as the surface

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of the rough ruthenium layer or ruthenium oxide layer, as recited in claims 30 and 36 respectively.

Second, obviousness can only be established by combining or modifying the teaching of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art (M.P.E.P. 2143.01). Applicants respectfully submit that Nakabayashi fails to provide a teaching, a suggestion, or a motivation to provide a conductive structure that includes at least a rough ruthenium layer or a rough ruthenium oxide layer, where a surface of the rough ruthenium layer, or a rough ruthenium oxide layer, has a surface area greater than about 1.2 times a surface area of a completely smooth surface having a substantially identical shape as the surface of the rough ruthenium layer, or the rough ruthenium oxide layer, as recited in claims 30 and 36.

In fact, Nakabayashi actually teaches away from the claimed invention. A prior art reference must be considered in this entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). Nakabayashi provides that "rough" ruthenium and ruthenium oxide surfaces are a "problem" (see Col. 7, lines 5-17; and Col. 14, lines 42-67) for which Nakabayashi provides a solution. As Nakabayashi identifies rough ruthenium and ruthenium oxide surfaces as a "problem", one skilled in the art considering Nakabayashi would have been lead away modifying such structures to make them rough. As such, Nakabayashi provides neither the suggestion or motivation for one skilled in the art to modify the document as asserted by the Examiner.

The Examiner also asserted that using a ratio of the surface of the rough ruthenium layer having a surface area greater than about 1.2 times the surface area of a completely smooth surface having substantially identical shape as the surface of the rough ruthenium layer is considered to be obvious in variation design, as this ratio is well known in the art, and thus

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would have been obvious to one skilled in the art to apply the appropriate ratio for a purpose of increasing the surface of the lower electrode. Applicants respectfully traverse these assertions.

As discussed above, one skilled in the art viewing Nakabayashi would not have been motivated to make such a variation in design, as Nakabayashi teaches that a rough ruthenium surface or a rough ruthenium oxide surface is a "problem". As such, Nakabayashi fails to provide a suggestion or a motivation to one skilled in the art to apply a ratio such as that claimed for the purpose of increasing the surface of the lower electrode as asserted by the Examiner.

For at least the above reasons, Applicants submit that claims 30 and 36 are not *prima facie* obvious in view of Nakabayashi. Reconsideration and withdrawal of this rejection are, therefore, respectfully requested.

Claims 31-35 and 37-40

With respect to dependent claims 31-35 and dependent claims 37-40, Applicants submit that claims 31-35 and 37-40 are not obvious in view of Nakabayashi for the same reasons as those stated above for claims 30 and 36, respectively. In addition, claims 31-35 and 37-40 each recite additional elements that further support patentability when respectively combined with independent claim 30 and 36.

In addition, Applicants respectfully submit that claims 31-35 and 37-40 are not *prima facie* obvious in view of Nakabayashi, for at least the following additional reasons. Nakabayashi, besides other things, fails to teach or suggest all the elements recited in the claims. For example, for claim 31 Nakabayashi fails to teach or suggest that the surface of the rough ruthenium layer has a surface area greater than about 1.5 times the surface area of the completely smooth surface having the substantially identical shape as the surface of the rough ruthenium layer. Nakabayashi also fails to teach or suggest that the surface of the rough ruthenium layer has an RMS roughness in a range of about 50 Å to about 600 Å, as recited in claim 32. In addition, Nakabayashi fails to teach or suggest that the surface of the rough ruthenium layer includes a nominal center cross-section area of grains in a range of about 100 Å to about 800 Å,

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Applicant(s) Deiderian et al.

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as recited in claim 33. Nakabayashi also fails to teach or suggest a conductive structure that further includes non-rough ruthenium having a surface region upon which the layer of rough ruthenium is formed, as recited in claim 34. Nakabayashi further fails to teach or suggest a conductive structure that further includes non-rough ruthenium oxide having a surface region upon which the layer of rough ruthenium is formed, as recited in claim 35.

Nakabayashi also fails to teach or suggest a conductive structure that further includes non-rough ruthenium oxide having a surface region upon which the layer of rough ruthenium is formed, as recited in claim 35. In addition, Nakabayashi fails to teach or suggest a conductive structure having a surface of rough ruthenium oxide layer that has a surface area greater than about 1.5 times the surface area of the completely smooth surface having the substantially identical shape as the surface of the rough ruthenium oxide layer, as recited in claim 37. Nakabayashi also fails to teach or suggest that the surface of the rough ruthenium oxide layer has an RMS roughness in a range of about 50 Å to about 600 Å, as recited in claim 38. In addition, Nakabayashi fails to teach or suggest that the surface of the rough ruthenium oxide layer includes a nominal center cross-section area of grains in a range of about 100 Å to about 800 Å, as recited in claim 39. Finally, Nakabayashi fails to teach or suggest a conductive structure that further includes non-rough ruthenium containing material having a surface region upon which the layer of rough ruthenium oxide is formed, as recited in claim 40.

For at least the above reasons, Applicants submit that claims 31-35 and 37-40 are not *prima facie* obvious in view of Nakabayashi. Reconsideration and withdrawal of this rejection are, therefore, respectfully requested.

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STRUCTURES/METHODS USING SAME**Summary**

It is respectfully submitted that the pending claims 30-40 are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted for  
**Micron Technology, Inc.**

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PATENT TRADEMARK OFFICE

By: 

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Date

13 Feb 2003

**CERTIFICATE UNDER 37 CFR § 1.8:**

The undersigned hereby certifies that this paper is being transmitted by facsimile in accordance with 37 CFR § 1.6(d) to the Patent and Trademark Office, addressed to Assistant Commissioner for Patents, Washington, D.C. 20231, on this 13<sup>th</sup> day of February, 2003, at 11:38am (Central Time).

By: 

Name: Sara E. Olson

**APPENDIX A - SPECIFICATION/CLAIM AMENDMENTS  
INCLUDING NOTATIONS TO INDICATE CHANGES MADE**

**Serial No.: 10/042,025**

**Docket No.: 150.00880102**

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Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted. Additionally, all amendments have been shaded.

**In the Claims**

For convenience, all pending claims are shown below.

30. A conductive structure comprising at least a rough ruthenium layer, wherein a surface of the rough ruthenium layer has a surface area greater than about 1.2 times a surface area of a completely smooth surface having a substantially identical shape as the surface of the rough ruthenium layer.
31. The conductive structure of claim 30, wherein the surface of the rough ruthenium layer has a surface area greater than about 1.5 times the surface area of the completely smooth surface having the substantially identical shape as the surface of the rough ruthenium layer.
32. The conductive structure of claim 30, wherein an RMS roughness of the surface of the rough ruthenium layer is in a range of about 50 Å to about 600 Å.
33. The conductive structure of claim 30, wherein a nominal center cross-section area of grains at the surface of the rough ruthenium layer is in a range of about 100 Å to about 800 Å.
34. The conductive structure of claim 30, further comprising non-rough ruthenium having a surface region upon which the layer of rough ruthenium is formed.
35. The conductive structure of claim 30, further comprising non-rough ruthenium oxide having a surface region upon which the layer of rough ruthenium is formed.

**Amendment and Response - Appendix A**

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Applicant(s): Derderian et al.

Serial No.: 0910/042,025

Filed: October 25, 2001

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36. A conductive structure comprising at least a rough ruthenium oxide layer, wherein a surface of the rough ruthenium oxide layer has a surface area greater than about 1.2 times a surface area of a completely smooth surface having a substantially identical shape as the surface of the rough ruthenium oxide layer.
- 37.(Amended) The conductive structure of claim 36, wherein the surface of the rough ruthenium oxide layer has a surface area greater than about ~~1.2~~ times the surface area of the completely smooth surface having the substantially identical shape as the surface of the rough ruthenium oxide layer.
38. The conductive structure of claim 36, wherein the RMS roughness of the surface of the rough ruthenium oxide layer is in a range of about 50 Å to about 600 Å.
39. The conductive structure of claim 36, wherein a nominal cross-section grain size of grains at the surface of the rough ruthenium oxide layer is in a range of about 100 Å to about 800 Å.
40. The conductive structure of claim 36, further comprising non-rough ruthenium-containing material having a surface region upon which the layer of rough ruthenium oxide is formed.

PATENT  
Docket No. 150.00880102IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Derderian et al. ) Group Art Unit: 2818  
Serial No.: 10/042,025 )  
Confirmation No.: 5745 ) Examiner: Phuc Dang  
Filed: October 25, 2001 )  
For: METHODS FOR FORMING ROUGH RUTHENIUM-CONTAINING LAYERS  
AND STRUCTURES/METHODS USING SAME

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Assistant Commissioner for Patents  
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PATENT TRADEMARK OFFICE

13 Feb 2003  
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Feb. 13, 2003  
Date

Signature: Sara E. OlsonName: Sara E. Olson

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